ESA-112 Welch Foods, Inc. Public Report

Introduction:

Steam is provided by two water-tube boilers; one rated at 100,000 Pounds per Hour (kPPH) output, and a second unit which is rated at 120 kPPH. The units are oversized for current processing plant loads which are normally in the 30 kPPH to 50 kPPH range. The boilers are located off-site, about 3,500 Ft. from the plant entrance, and are operated by a third party, which also operates an 80 MW combined cycle cogeneration plant. Cogeneration plant operation has become highly intermittent, so the boilers are the principal source for steam at the Welch's plant.

Steam leaves the Boiler Plant at 160 PSIG; 360 F, and enters the processing plant by contract requirement at no less than 135 PSIG to 148 PSIG at saturated condition. During the site visit, the delivered condition was observed to be 143 PSIG; 362 F. The flow rate was 33,400 PPH.

The contract to purchase steam from the off-site steam generation facility will remain in effect until 2016, with provisions for extension. The annual cost of steam is approximately $3.6 million.

During the walk-through of the boiler plant it was observed that minimal instrumentation exists in the steam plant. The 100 kPPH unit is manufactured by ABCO, and the burners are by the Coen Company. The burner control panel contains a variety of displays that describe the burner and boiler conditions. Flue gas temperature is not monitored. The 120 kPPH unit was manufactured by Zurn. It was not in operation during the site visit. Both boilers are equipped with economizers for make-up water preheating.

Condensate leaves the Processing Plant at approximately 200 F. It is discharged into a very large demineralized water tank which is a common source for treated boiler feed water for both the cogeneration steam generators and the boilers. When the cogeneration plant is not in operation (normal mode) the large quantity of cool demineralized water reduces the temperature of the condensate to around 100 F. A temperature of 104 F was observed during the site visit. The effect of the dilution with the water in the tank is a significant source of heat loss in the condensate return system.

From a review of the ABCO boiler's performance data, the unit ratings are based on receiving water at 5 PSIG; 227 F. Demineralized water is heated in the deaerator by boiler steam to 227 F at 5 PSIG. The deaerator manufacturer's performance data indicates that the steam flow to the unit to meet this condition is approximately 18% of the boiler output. However, the actual feedwater heating load on the boilers is related to the temperature of the treated water that enters the deaerator. Clearly, the contribution of boiler steam to meet the feedwater design condition is much greater if the treated water is returned at 100 F as compared to 200 F.

During the plant visit it was revealed that water treatment practices, in particular the chemical treatment contractor's recommendation to maintain Total Dissolved Solids in the range of 180 to 250 is being reviewed.

The ABCO boiler is operated with a Flue Gas Recirculation fan. Both boilers have state-regulated environmental controls for NOx. Continuous Emissions Monitoring (CEM) is in effect. Proposals for burner modifications to derate both boilers, and expand turn-down are being solicited. This should improve efficiency at light loads, and eliminate costs associated with the CEM requirement.

Focus of Assessment:

The focus of the Assessment was on the operation and efficiency of the boiler plant operated by a third party source. The condition and performance of the distribution pipelines and steam equipment in the Welch plant also was assessed.

Approach for ESA:

The approach included the following:

1. Reviewing current energy consumption patterns
2. Meetings/interviews with steam system operations and management personnel
3. Surveys of existing facilities
4. Identification and analysis of energy conservation opportunities

General Observations of Potential Opportunities:

Annual consumption as reported on the ESA application is as follows;

- Imported electricity: 27,000,000 kWh (90 MMBTUs)
- Natural Gas: 300,000 MMBTUs

Electricity is provided to the plant by the local utility, Penelec, a part of the FirstEnergy. The benchmark unit cost of electricity is around $0.055/kWh. Intermittent outages occur, and cost increases are expected during the next four years.

Energy Conservation Opportunities:

Energy Conservation Opportunities identified are discussed below. SSAT analyses were performed to quantify energy savings potential. These results are provided below.

Near-Mid Term

- **Reduce Steam Demand** —Opportunities to improve plant and system efficiency exist through a variety of strategies, beginning with operations. A key element is improvement in metering and instrumentation. Flow and steam quality are monitored, as are emissions characteristics through the CEM. However, make up water is not metered, stack gas temperature read-outs do not exist, and steam use by the various processes in the Welch plant are not sub-metered. Boiler efficiency is not monitored or periodically tested or calculated. A program to upgrade instrumentation and metering should be implemented at both the Boiler Plant and the Process Plant with the expectation that a 2% to 5% reduction in steam demand and energy use will result. In order for this to occur the instrumentation upgrades must be accompanied with a management strategy to summarize and report key energy use indicators on a monthly basis.

  Using the SSAT Model (version 2) and assuming a 3% load reduction effect due primarily to distribution system submetering, savings of $126,000/year result at a natural gas of $7/MMBTUs. Installation costs of $200,000 to $500,000 are applicable to this measure—depending on information needs. An allowance for operating costs to monitor, and analyze the data, as well as maintain the meters must be included for this measure.

- **Change Boiler Efficiency –** As noted above, proposals to modify the burners for both boilers are being solicited. The objective is to expand turn-down ratio and reduce maximum output to eliminate the regulatory requirement for Continuous Emissions monitoring. While on site, the Oxygen content was observed to be just under 5 %. Efficiency increases of 2% to 3% should be possible as a result of automated burner controls to maintain oxygen at lower levels. In addition, operating cost savings will occur if the fuel input to the boilers is reduced to eliminate the need for Continuous Emissions Monitoring (CEM). However some upgrade in controls will be needed as the CEM is used in part to monitor plant operation. Consideration should be given to using the same burner manufacturer for the upgrade to both boilers, and the installation of a master controller for both boilers. Assuming a 2% natural gas savings from the controls upgrade, the annual cost reduction is estimated to be $105,000.

  A preliminary proposal for a turn-key installation to upgrade the burner for the ABCO boiler has been received, with the cost being approximately $90,000. However, the scope does not appear to address derating the fuel input to eliminate the need for CEM. This proposal does not address modifying the Zurn boiler, nor does it consider the need for some form of master controller; which is likely to be needed as the operators use the CEM information for plant operation. Based on a preliminary discussion with COEN, a cost in the range of $150,000 to $350,000 can be anticipated for this measure.

- **Implement Steam Trap Maintenance Program**– A steam trap survey was conducted within the last year, though this had not been done in several years prior. An inventory of traps, locations, and types should be developed and the traps routinely monitored and replaced as needed. The SSAT model indicates savings of $30,000 per year are attainable if a long term steam trap maintenance program is implemented. The initial cost to institute this program is expected to be less than $100,000. However, a variety of approaches are available to accomplish the desired end result. Whatever approach is adopted, expense associated with staff time to monitor trap condition and perform the required maintenance activities on a yearly basis need to be included in the budgeting for this measure.

- **Improve Insulation**—As noted above, insulation needs to be added on some distribution system and boiler plant piping. In the Processing Plant most steam and condensate lines are well insulated, though segments of piping, and some devices such as valves, are not insulated. An inventory of uninsulated pipes and devices should be developed and the needed insulation installed. Using the SSAT and 3E Plus tools, the estimated savings associated with the improved insulation measure is $4000/year at the natural

gas cost indicated above. The analyses were based on a rough approximation of slightly more than 2000 Ft. of steam header piping of various sizes, and an equivalent of approximately 200 Ft. (and some valves and other appurtenances) requiring insulation repair. Using a cost range of $10 to $25/Ft. of pipe, the cost budget for this measure is in the range of $2000 to $5000.

- **Condensate Heat Recovery**—As described above condensate from the Processing Plant is returned to a large demineralized water tank. During the site visit it was observed that the condensate return temperature was reduced to approximately 100 F. It was reported that this occurs due to dilution with cool process water, when the CHP plant is not operational. Two options exist to eliminate or reduce the amount of energy wasted. One is to install a dedicated water treatment system for the auxiliary boilers. A second option is to design and install a heat recovery system to extract the heat from the condensate before it enters the demineralized water tank and preheat the boiler feedwater before it enters the deaerator. A water heat recovery system involving piping, pumps and two heat exchangers would heat the 104 F demineralized water to 185 F.

  Using the SSAT the estimated savings is $178,000 per year. The cost to implement one of the two solutions described above is expected to be in the range of $75,000 to $150,000.

- **Eliminate Water Hammer in Condensate Return Line**—Anecdotal information was provided during the site visit about the occurrence of water hammer in the condensate return from the Processing Plant to the Boiler Plant. Additional analysis of the design and operation of the condensate return system was recommended in order to determine the cause of the problem and a recommended solution.

Long Term

- **Change Boiler Efficiency; Replacement Boiler Plant**—A variety of approaches can be considered for a replacement plant, should Welch's be interested in pursuing this at the end of the contract term. One option is installing one small boiler (approximately 50 kPPH) for light load operation—initially, to serve during periods when the Processing Plant experiences low loads (seasonal and daily fluctuations). The installation of a smaller boiler—sized to improve efficiency during light load operation could be in the former absorption refrigeration building; thereby starting the process of re-establishing a steam generation facility on the Welch's property. An SSAT analysis of this option was conducted, assuming the small boiler would operate for 5000 hours per year. The estimated savings is $93,000. A budgetary cost for this measure is estimated to be in the range of $900,000 to $1.2 million.

- **Change to 2 header pressure operation**—many of the end uses in the Processing Plant require steam at maximum pressures of 60 PSIG and lower. Two evaporators which represent a total load of 16,000 PPH currently set the peak pressure requirement. Potential savings of $229,000 per year were identified. While it was not possible to develop a budget for the piping alterations that would be required, the estimated savings would justify an expenditure of $450,000 to $680,000 to accomplish two or three year payback periods.

Management Support and Comments:

The systems and operating practices in place at the site are replicated at other facilities. It is planned to share the findings and results of the ESA with Facilities personnel at the other locations.

Response to Survey on Energy practices has been completed and submitted to Oak Ridge National Laboratory.

DOE Contact at Plant/Company: Same as corporate Lead.